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Complete Specification entitled (54) PRECISION STAMPING PRESS

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The following statement is a full description of this invention, including the best method of performing it known to us:

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The invention relates to a precision stamping press with two rigidly interconnected frame members, to which two table members, which serve the purpose of clamping two tool parts and which are axially relatively displaceable towards and away from each other by hydraulic means, are attached, a cylinder chamber being provided in the first frame member, in which two relatively movable co-axial pistons are provided, the first of which being connected to a piston rod, and the second of which surrounds this piston rod and defines part of the first table member which is relatively displaceably secured to the first frame member, the piston rod and the table member being selectively connectable to the frame member, for the purpose of enabling tools to be selectively used in the press, which operate relative to the table member, either with a movable blanking punch and a fixed annular prong ring or with a fixed blanking punch and a movable annular prong ring. In a press of this kind, which, for example, is known from the published German specification 1'930'398, when the type of tool has to be changed, either the piston rod or the table member has to be secured by means of screws to the frame member, which is inconvenient and time-consuming. Furthermore, valves have to be inserted in a hydraulic system which supplies the press with pressure fluid, depending on the type of the replacement tool, and the possibility of faulty operation cannot be eliminated.

The invention eliminates these disadvantages by providing a change-over device, which has two relatively adjustable complementary distance pieces, relative adjustment of which enables the table member to be connected or not connected to the frame member; a first and a second channel in the frame member leading to the cylinder chamber, through which channels pressure fluid can reach only one or the other side of the first piston, so that when the cylinder is supplied through the first channel, the first piston and hence the piston rod is connected to the frame member, whilst not being so connected when it is supplied through the second channel; an operating element for the relative adjustment of the complementary distance pieces cooperating with two limit switches, which control the excitation circuits of two electro-magnets of a change-over valve, which in a first terminal position supplies pressure fluid to the first channel and in a second terminal position to the second channel, and the table member in this second terminal position being connected by the distance pieces to the frame member and not so connected in the first terminal position. Solely by operation of a single operating element, e.g. the pivoting of a lever, the press is thus entirely changed over both mechanically and hydraulically from one type of tool to the other.

A preferred form of precision stamping press in accordance with the invention, moreover, when used with a

movable blanking punch and also when used with a fixed blanking punch, enables, in an extremely simple manner, e.g. by turning a handle, to compensate for shortening of the blanking punch, resulting from sharpening of the latter by grinding, and which hitherto necessitated an extremely difficult and time-consuming adjusting operation involving the insertion of distance washers.

An embodiment of the subject of the invention is shown diagrammatically and by way of example only, in the drawing, in which :

Figure 1 is a vertical section through a precision stamping press on line I-I in Figure 2, in operation with a tool having a movable blanking punch;

Figure 2 is a cross-section on line II-II in Figure 1,

Figure 3 is the same section as in Figure 1, but only through the upper portion of the press and in operation with a tool having a fixed blanking punch,

Figure 4 is a diagrammatic representation of a portion of a change-over device in a position for operation with a movable blanking punch, and

Figure 5 is a representation corresponding to Figure 4 for operation with a fixed blanking punch.

The precision stamping press shows a frame 1, consisting of a lower frame member 2, an upper frame member 3 and four columns 4, which connect the two members 2 and 3 together. In the lower member 2 a cylindrical cavity

5 is provided in which a piston 6 is located, which is connected via a piston neck 8 passing through a bore 7 in the member 2, to a lower table member 9; the latter has four bores 10, by means of which it is guided along the columns 4. A cylindrical cavity 11 is also provided in the table member 9, the cavity 11 contains a piston 12, which is releasably connected via a piston neck 14 guided in a bore 13 in the member 9 to an ejector punch 15 forming part of the tool. The lower frame member 2 and the lower table member 9 in fact consist of at least two or three parts secured together by screws, which is necessary for assembly purphoses, but irrelevant to an understanding of the operation of the press and which has therefore not been shown. The same also applies to other parts of the press to be described hereinafter, and no further reference will be made to this fact.

In the frame member 2 two channels 16 and 17 are provided, which serve the purpose of supplying oil under pressure to the lower and upper working surface respectively of the piston 6. Likewise in the table member 9 a channel 18 is provided which serves the purpose of supplying oil under pressure to the lower working surface of the piston 12. A channel 19 serves the purpose of venting the upper part of the cylinder 11. The base 21 of a tool is clamped by means of screws (not shown) to the upper surface 20 of the table member 9. The base 21 has a bore 22 through which

the ejector punch 15 extends.

To the lower surface 23 of an upper table member 24 an annular upper part 25 of a tool is clamped, which is provided on its lower side with an annular prong 25, by which a sheet metal strip 27 on which an operation is to be performed is pressed against the base 21 of the tool prior to the stamping cut being performed.

Laterally of the sheet metal strip 27, one or more pairs of apertures 28 and 29 are provided in relative register in the two tool parts 21 and 25, in which dowel pins 30 are located, for providing accurate guidance of the two parts 21 and 25 during the closing movement of the press.

In the upper frame member 3 a cylindrical cavity 31 is provided in which two pistons 32 and 33 are located, which have a hollow spindle 34 defining a piston rod passing through them, the piston 32 being axially movable relative to this spindle 34. The piston 33, on the other hand, is connected to the spindle 34 for axial movement therewith, its axial position relative to the latter, however, being adjustable. For this purpose a sleeve 35 is provided which at its lower end rests on a shoulder 36 of the hollow spindle 34 and at its upper end is held by a ring 37 secured to the latter. The sleeve 35 has an external screw thread 38 which engages with an internal screw thread 39 of the piston 33. At the upper end of the

sleeve 35 a chain wheel 40 is attached, which is engaged by a chain (not shown) which forms part of a kinematic connection 41 to an adjusting crank handle 42.

In order to avoid rotation of the hollow spindle 34 relative to the lower piston 32, when the sleeve 35 is screwed down or up in the piston 33, a key 43 secured to the hollow spindle 34 and extending longitudinally, engages in a longitudinal groove 44 in the piston 32. At the bottom end of the hollow spindle 34 a blanking punch 45 forming part of the tool is secured by menas of a bolt 46, which passes through the hollow spindle 34 and whose head 47 rests on the upper end of the hollow spindle 34. As a rule, the blanking punch 45 is not round and for this reason rotation of the hollow spindle 34 is not admissible. Clearly the cutting edge of the blanking punch 45 has to be located opposite the cutting edge of the complementary lower part 21 of the tool.

The lower piston 32 and a piston neck 49 disposed in a bore 48 of the upper frame member 3 are part of the upper table member 24. As can be seen in Figure 2, the piston neck 49 consists of four sectors 49a, separated by wide slits 50, in which four radial arms 51 extending from the hollow spindle 34 extend and to each of which a downwardly extending pin 52 is attached. The four pins 52 engage in the corresponding number of bores 53, which extend in the table member 24 from the lower end of the

slits 50 to the lower surface 23 of the table member 24. The pins 52 themselves also prevent rotation of the hollow spindle 34, so that the key 43 is provided only for the purpose of additional reliability on account of the possibilit of a small amount of elastic deformation of the parts 51 and 52 or of play in the bores.

On a broad annular shoulder 54 of the table member 24 provided below the piston neck 49 lies a distance ring 55, surrounding the piston neck 49, which has eight equi-distant apertures 56 arranged in a circle. The position of the distance ring 55 in Figures 1 and 4 is such that its eight apertures 56 are aligned with a corresponding number of pins 57 which are complementary to the apertures and which protrude from a lower annular face of the frame member 3. These pins 57 therefore do not prevent an upward movement of the table member 24, corresponding to the height of the distance ring 55 because they are able to enter the apertures 56. If, however, the distance ring 55 is displaced into the position shown in Figures 3 and 5, the apertures 56 are no longer aligned with the pins 57, so that the latter prevent any upward movement of the table member 24 by abutting against the distance ring 55, and thus they hold the table member 24 in place on the frame member 3.

The distance ring 55 can be pivoted by means of a lever 58 which at the same time serves to operate two

position detecting means in the form of limit switches 59 and 60, secured to the upper table member 24 (not shown in Figures 1 and 2), of which in the terminal position according to Figure 4 the switch 59 is closed and the switch 60 open, whilst in the terminal position according to Figure 5 the reverse is the case.

The switches 59 and 60 are connected in the excitation circuit of two electro-magnets 61 and 62 of a conventional change-over valve 63 (shown diagrammatically) with three switching positions.

In a first terminal position shown in Figure 1, which corresponds to the switch 59 being closed and the switch 60 being open, the valve 63 places a source 64 of oil under pressure in communication with a first channel or duct 66 provided in the upper frame member 3, via a conduit 65. At the same time the valve 63 places a second channel or duct 67 provided in the upper frame member 3 in communication with an oil sump 69 via a conduit 68.

In a second terminal position shown in Figure 3, which corresponds to the switch 60 being closed and the switch 59 being open, the valve 63 places the source 64 of pressure oil in communication with the channel 67 via the conduit 68 and the oil sump 69 with the channel 66 via the conduit 65.

In an intermediate position of the valves 63 (not shown) which corresponds to the case in which the lever 58

has not been pivoted into one of its terminal positions, both the channels 66 and 67 are in communication with the oil sump 69, whilst the source 63 of pressure oil is cut out entirely, so that the possibility of energisation of the pistons 32 and 33 is eliminated, when the apertures 56 and the complementary pins 57 are not in an overlapping position.

The channel 67 opens directly into the upper end of the cylinder chamber 31. The channel 66 on the other hand is in communication with a channel 71 extending axially through the piston 33, via a sealing land 70. The top of the gland 70 is attached to the frame member 3 and at its lower end the gland engages an annular enlarged portion 72 of the channel 71, so that, whilst preventing oil from being discharged above the piston 33, it nevertheless permits axial displacement of the latter in the cylinder chamber 31 between its terminal positions shown in Figures 1 and 3.

The press described, when equipped with the tool, 21, 15, 25, 45 shown in Figure 1, whose blanking punch 45 is movable relative to the table member 24 to which the annular prong ring 25 is adapted to the clamped, works as follows:

From the source 64 the pressure oil reaches the underside of the piston 33 via the control valve 63, the conduit 65 and the channels 66 and 71 which communicate

via the sealing gland 70. Thereby the piston 33 is pressed against the upper end face 73 of the cylinder chamber 31, and the piston 32 against a lower shoulder 74 of the latter. If now in the lower frame member 2, pressure oil is admitted via the channel 16 to the cylinder chamber 5 and thereby the lower table member 9 is moved upwardly by its piston 6, the press initially closes, the base 21 of the tool coming to lie against the annular prong ring 25 via the metal sheet 27, the annular prong 26 penetrating the metal sheet 27. As the piston 6, which in its capacity of power piston for supplying the energy required for the cutting operation, continues to move upwards, the upper table member 24 is moved via the annular prong ring 25 against the pressure acting above the piston 32, whilst the pins of the distance piece 57 enter the apertures 56 of the distance ring 55. The blanking punch 45 which butts against the wall 73, i.e.against the upper frame member 3, via the hollow spindle 34, the sleeve 35 and the piston 33 does not move with the upper table member 24, and consequently cuts through the metal sheet 27.

Pressure oil is now admitted to the channel 17, whereby the lower table member 9 is lowered. By applying pressure to the piston 12 via the pressure oil channel 18, the ejector 15 is then operated. The sheet metal strip 27 is then appropriately traversed and the operating cycle repeated.

In Figure 3 a blanking punch 75 is shown, which is secured to the lower face of the upper table member 24, whilst the annular prong 26 is attached to a ring 76 which is movable relative to its associated member 24, having four upwardly directed pins 77, which connect the ring 76 with the pins 52 which extend downwardly from the arms 51 of the hollow spindle 34. As has already been explained, the distance pins 57 are now located intermediate the apertures 56 of the distance ring 55, whereby any upward movement of the table member 24 is prevented. The pressure oil reaches the cylinder chamber 31 via the channel 67 above the piston 33, and this piston 33 consequently presses the piston 32 on to the shoulder 74.

The lower part of the press, which has been omitted in Figure 3, is the same as that in Figure 1, except for the fact that the lower parts 15, 21 of the tool must of course match the latter's upper parts 75 and 76. During the working stroke of the power piston 6 the press is again initially closed as the annular prong 26 penetrates the metal sheet 27. Thereupon the annular prong ring 76 which abutts against the upper piston 33 via the parts 77, 52, 51, 34, 35, is displaced upwardly, in that the thrust of the power piston 6 overcomes the thrust exerted on the piston 33 by the pressure oil, so that the blanking punch 75 which lies firmly on the table member 9 cuts through the metal sheet 27.

It yet remains to be explained why adjustability of the axial position of the hollow spindle 34 relative to the piston 33 is provided. This adjustability is provided for the purpose of compensating for the shortening of the blanking punch after the cutting face of the stamping punch 45 or 75 has been reground. Hitherto it was necessary to insert distance washers corresponding to the foreshortening of the punch between the punch and the hollow spindle 34 or the table member 24. This used to be a very time-consuming job, which as a rule had to be done once or twice a day. With the presently described press, on the other hand, it is only necessary to turn the crank handle 42 sufficiently for the end face of the punch to come into contact with an appropriate calibration blank. In the case of a tool with a movable blanking punch 45, a non-ajustable spindle would be too short after regrinding. Hence, the sleeve 35 has to be screwed downwards in the piston 33, taking the hollow spindle 34 with it appropriately in the process. In the case of a tool with a fixed blanking punch 75, the pins 52 would be too long after regrinding. Consequently the sleeve 35 has to be screwed upwardly in the piston 33, taking the hollow spindle 34, and thus also the arms 51 and the pins 52 with it in the process.

It follows from the foregoing description, that it is the design of the upper part of the press shown which is essentially of significance to the invention.

Since, however, in place of the vertical columns 4 a horizontal base could serve the purpose of rigidly connecting the two frame members 2 and 3, the claims refer not to an upper and lower, but more generally, to a first and a second frame member, table member, etc.

The complementary distance pieces 55 and 57 need not necessarily consist of an apertured, rotatable distance ring 55 and a circular arrangement of pins 57 matching the apertures. For example, in place of apertures, suitable marginal recesses could be provided in a square frame for receiving pins, and such a frame could be displaced by means of any operating element from one terminal position to the other.

The claims defining the invention are as follows:

1. A precision stamping press with a first and a second rigidly interconnected frame member, to which a first and a second table member which serve the purpose of clamping two tool parts and which are axially relatively displaceable towards and away from each other by hydraulic means are respectively attached, a cylinder chamber being provided in the first frame member, in which a first and a second relatively movable co-axial piston are provided, a first said piston being connected to a piston rod and a second said piston surrounding this piston rod and defining part of the said first table member which is relatively displaceably secured to the said first frame member, the piston rod and the said first table member being selectively connectable to the said first frame member, for the purpose of enabling a variety of tools to be used in the press, which operate (relative to the said first table member) either with a movable blanking punch and a fixed annular prong ring, or with a fixed blanking punch and a movable annular prong ring, a change-over device being provided which has two relatively adjustable complementary distance pieces, relative adjustment of which enables the said first table member to be connected or not connected to the said first frame

member; wherein a first and a second duct in the said first frame member leads to the said cylinder chamber, through which ducts pressure fluid can reach only one or the other side of the said first piston, so that when the cylinder chamber is supplied through the said first duct, the said first piston and hence the said piston rod is connected to the said first frame member, whilst not being so connected when it is supplied through the said second duct, an operating element for the relative adjustment of the said complementary distance pieces co-operating with position detecting means, which control a change-over valve which in a first terminal position supplies pressure fluid to the said first duct and in a second terminal position to the said second duct, the said first table member being in ~~th is~~ the second terminal position connected via the distance pieces to the said first frame member, whilst not being so connected in the first terminal position.

2. A precision stamping press according to claim 1, wherein one of the distance pieces consists of a ring angularly displaceable about its axis by means of a lever, the ring having equi-distant apertures arranged in a circle and lying on a shoulder of the said first table member, the other distance piece comprising pins arranged in a circle and fitting into these apertures, the pins

protruding from the said first frame member, and the arrangement being such that, in the said first terminal position the pins are aligned with the apertures and in the said second terminal position they are not.

3. A precision stamping press according to claim 1, wherein the piston rod is defined by a hollow spindle from which radial arms extend, to which axially directed pins are attached, the arrangement being such that, in operation with a blanking punch which is movable relative to the said first table member, this punch is secured to the inner end of the hollow spindle by means of a bolt extending through the hollow spindle, whilst in operation with a blanking punche which is stationary relative to the said first table member, the annular prong ring abutts the first-mentioned pins via further axially directed pins.

4. A precision stamping press according to claim 3, wherein a sleeve having an external screw thread is rotatably but not axially movably secured to the hollow spindle, this external screw thread being screwed into an internal screw thread provided in the said first piston, a driving element being provided at an end of the said sleeve which protrudes from the said first frame member, and the said driving element being connected via a kinematic connection to a setting element, actuation of which renders

the hollow spindle axially adjustable with respect to the said first piston, for the purpose of compensating for any reduction in length of the movable or fixed blanking punch caused by regrinding of the latter.

5. A precision stamping press according to claim 1, wherein the said first duct is in communication with a further duct extending through the said first piston, via a sealing gland.

6. A precision stamping press constructed, arranged and adapted to operate substantially as hereinbefore described with reference to, and as illustrated in, Figures 1, 2 and 4, or Figures 2, 3 and 5 of the accompagnying drawings.

7. A stamping when made in a precision stamping press according to any one of the preceding claims.

Dated this 9th day of May 1973

HYDREL AG.
By its Patent Attorneys
ARTHUR S. CAVE & Co.

55,496 ПЗ

Fig.1

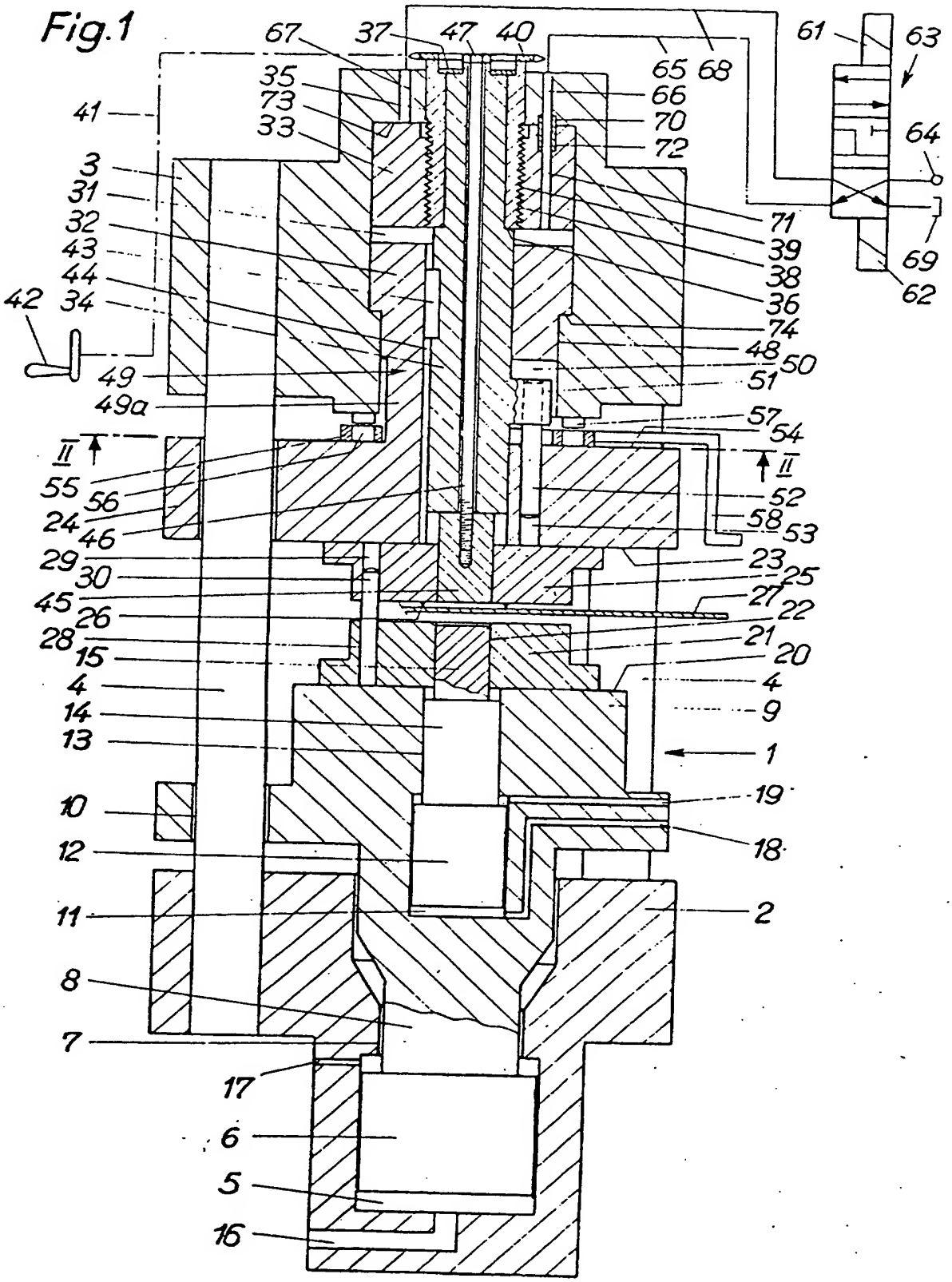


Fig.3

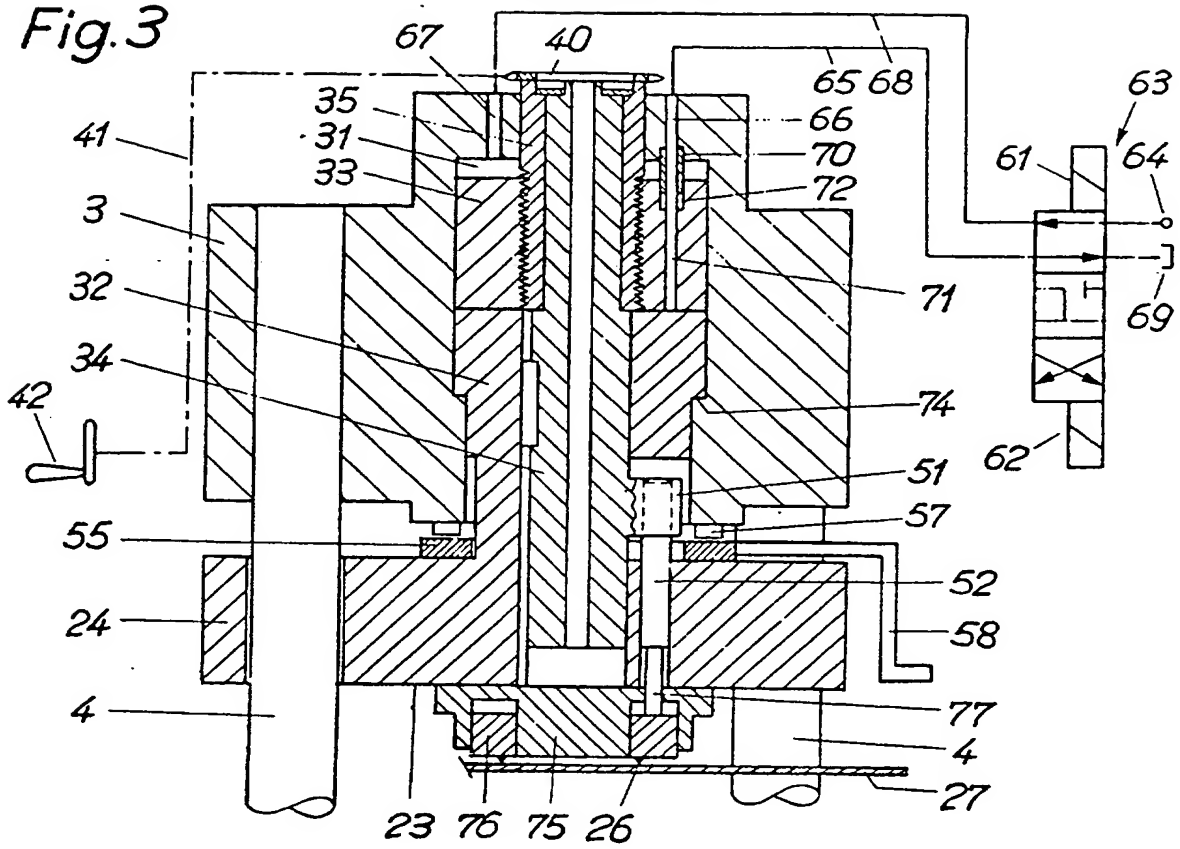
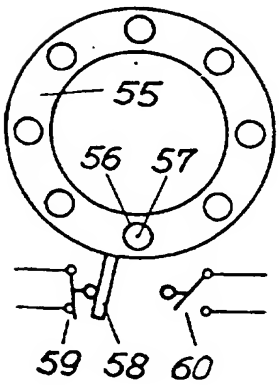


Fig.2

Fig.4



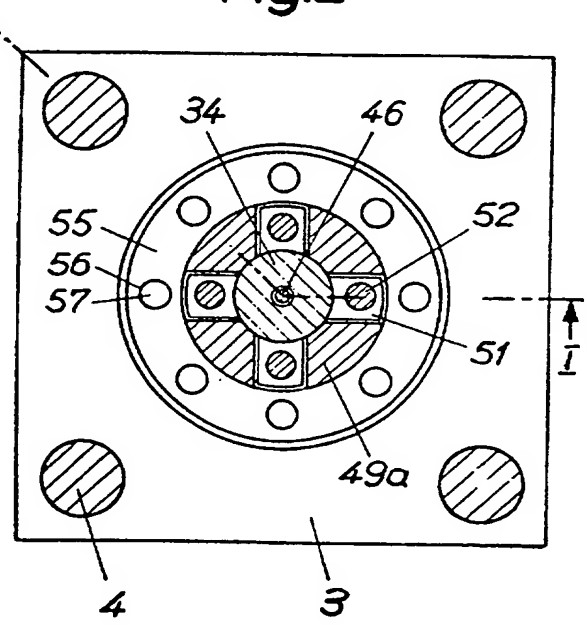
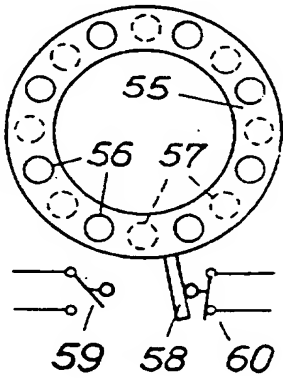


Fig.5



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